

Anil K. Jain

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EDUCATION

Ohio State University
Ph.D. Electrical Engineering 1973
M.S. Electrical Engineering 1970

Indian Institute of Technology, Kanpur
B. Tech. Electrical Engineering 1969

EMPLOYMENT

1992 - Present
University Distinguished Professor, Michigan State University
1995 - 1999
Chair, Department of Computer Science & Engineering, Michigan State University
1974 - 1982
Professor, Associate Professor, and Assistant Professor,
Department of Computer Science, Michigan State University
1980 - 1981
Program Director, Intelligent Systems Program, National Science Foundation
1972 - 1974
Assistant Professor, Department of Computer Science, Wayne State University

Visiting Professor: IIIT-Hyderabad; Korea University; Tsinghua University; Hong Kong Polytechnic University; ETH, Zurich; University of Bonn; Technical University of Lisbon; University of Oslo; IBM T. J. Watson Research Center; Hong Kong University of Science and Technology; Osaka University; Norwegian Computing Center; Tata Research Development and Design Center, India; Delft Technical University.

AWARDS AND RECOGNITION

- Foreign member, Chinese Academy of Sciences (CAS), elected 2019
- Board of Trustees, Mohamed bin Zayed University of Artificial Intelligence (MBZUAI), Abu Dhabi, 2019-Present
- Board of Advisors, Inception Institute of Artificial Intelligence (IIAI), Abu Dhabi, 2019-Present
- Fellow, The World Academy of Science (TWAS), elected 2019
- *Doctor Honoris Causa*, Universidad Autónoma de Madrid (UAM), 2018
- Distinguished Alumni Award, Indian Institute of Technology (IIT) Kanpur, 2017
- Member, National Academy of Engineering, elected 2016
- Foreign Fellow, Indian National Academy of Engineering, elected 2016
- Member, AAAS Latent Fingerprint Study Group, 2015-2017
- Fellow, National Academy of Inventors, elected 2015
- IAPR Senior Biometric Investigator Award, 2014
- Member, NIST Forensic Science Standards Board, 2014-2016
- Withrow Teaching Excellence Award, Michigan State University, 2014

- Member, IDIAP Scientific Advisory Committee 2013-
- Member, National Academies Panels on Information Technology (2010-2012); Improvised Explosive Devices (2005-2007); Biometrics (2005-2009)
- Member, Research Grants Council (Engineering), Hong Kong, 2008-2018
- Member, United States Defense Science Board, 2008-2010
- IEEE ICDM Research Contributions Award, 2008
- King-Sun Fu Prize, International Association of Pattern Recognition (IAPR), 2008
- IEEE W. Wallace McDowell Award, 2007
- Fellow, SPIE 2005; AAAS 2005; ACM 2003; IAPR 1996; IEEE 1991
- PSP Award from the Association of American Publishers for *Handbook of Fingerprint Recognition*, Springer, 2003
- Pierre Devijver Award, International Association of Pattern Recognition, 2002
- Alexander von Humboldt Research Award, 2002
- John Simon Guggenheim Fellow, 2001
- Fulbright Research Scholar, 1998
- ACM National Lecturer, 1997-98; IEEE Computer Society Distinguished Lecturer, 1988-1990
- Ohio State University, College of Engineering Distinguished Alumni Award, 1997
- Member, IEEE Publications Board, 1989-90
- Michigan State University Distinguished Faculty Award, 1989
- National Merit Scholar, Government of India, 1963

PAPER AWARDS

- Best Conference Paper Awards: IEEE ICB, Crete, Greece, 2019; IEEE BIOSIG, Darmstadt, Germany, 2016; IEEE BTAS, Washington DC, 2013, 2012, 2010, 2009; IEEE ICB, New Delhi India, 2012; IEEE IJCB, Washington DC, 2011; IEEE SIBGRAPI, Brazil, 2010; IEEE ICPR, Istanbul, Turkey 2010; IEEE ICB, Alghero, Italy, 2009; IEEE ICPR, Tampa, 2008; BYSM, Tampa, 2008; PCM, Hong Kong, 2007; IEEE ICPR, Hong Kong, 2006; IEEE ICB, Hong Kong, 2006; IEEE AVBPA, Rye Brook, NY, 2005; IEEE SDM, Orlando, 2004; IEEE ICIP, Kobe, 1999; ICDAR, Montreal, 1995
- Most Cited Paper Award, for "Data Clustering: 50 years beyond K-means", Vol. 31, issue 8, Pattern Recognition Letters, 2013 (#Citations = 5,704, May 2019)
- Pattern Recognition Journal, Best Paper Awards for 2005, 1991, 1987
- IEEE Transactions on Neural Networks, Outstanding Paper Award, June 1996

CONFERENCE / WORKSHOP ORGANIZATION

- International Conference on Pattern Recognition (ICPR), Beijing, 2018; Istanbul, 2010; Cambridge (UK), 2004; Brisbane, 1998; The Hague, 1992
- Program on Statistics and Applied Mathematics in Forensic Science, SAMSI, Research Triangle Park, NC, 2015-16
- International Conference on Biometrics (ICB), New Delhi, 2012, Seoul, 2007, and Hong Kong, 2006, 2004;
- NSF Workshops on "Research Agenda in Biometrics", Morgantown, 2003; "Challenges of Computer Vision", Maui, 1991; "Theory and Applications of Markov Random Fields", San Diego, 1989; "Indo-US Workshop on Computer Research Collaboration", Hyderabad, 1988; "Range Image Understanding", East Lansing, 1988

- Energy Minimization Methods in Computer Vision and Pattern Recognition, Sophia-Antipolis, France, 2001
- IEEE Computer Vision and Pattern Recognition (CVPR) Conference, Santa Barbara, 1998
- NATO Advanced Research Workshop on Real-Time Object Tracking and Classification, Maratea, Italy, 1987

EDITORIAL BOARDS

- *Editor in Chief*: IEEE Transactions on Pattern Analysis and Machine Intelligence, 1991-1994
- *Associate Editor*, ACM Trans. Knowledge Discovery in Data, 2006-2010; IEEE Trans. Information Forensics and Security, 2005-2010; Pattern Recognition Journal, 1989; IEEE Trans. Pattern Analysis and Machine Intelligence, 1986-1990; IEEE Trans. Neural Networks, 1994-1999; Applied Intelligence, 1980-1990; Journal of Mathematical Imaging and Vision, 1990-1999; Pattern Recognition Letters, 1974-1984
- *Guest Editor*: Pattern Recognition Journal, 2003, 2002, and 1997; IEEE Computer, 2000; IEEE Trans. Neural Networks, 1997

KEYNOTE SPEAKER

- Beijing Academy of Artificial Intelligence (BAAI) Annual Conference, June 21-23, 2020
- Global Congress on Biometric Identification, Shenzhen, Oct 19, 2018
- 13th Chinese Conference on Biometric Recognition, Urumqi, Aug 11-12, 2018
- 11th Int'l Conf. on Biometrics, Gold Coast, Australia, Feb 20-23, 2018
- 13th Int'l Conf. on Signal Image Tech. & Internet Based Systems, Jaipur, India, Dec 4-7, 2017
- 4th ID4Africa Conf., Windhoek, Namibia, Apr 26-28, 2017
- 103rd Indian Science Congress, Jan 4, 2016
- Federal Reserve Bank, Atlanta, Workshop on Banking on Biometrics, Nov 17, 2015
- NIST Center of Excellence on Forensic Science, Ames, Iowa, Oct 27, 2015
- The Royal Soc. Symp. on the Paradigm Shift for UK Forensic Science, London, Feb 2-3, 2015
- Microsoft 21st Century Computing Conf., Beijing, Oct 29, 2014
- Workshop de Visao Computacional, Uberlandia, Minas Gerais, Brazil, Oct 6-8, 2014
- Int'l Joint Conf. on Biometrics, Tampa, Sept 29-Oct 2, 2014
- EU COST Workshop on BiForD, Opatija, Croatia, May 28-29, 2014
- National Conf. on Computer Vision, Pattern Recognition, Image Processing and Graphics, Jodhpur, India, Dec 18-21, 2013
- Fall National Conf. of Korean Institute of Info. Scientists & Engineers, Jeju, Nov 15-16, 2013
- Int'l Carnahan Conf. on Security Technology, Medellin, Colombia, Oct 2013
- Int'l Conf. on Advanced Computer Science and Information Systems, Bali, Sept 2013
- Int'l Conf. of the Biometrics Special Interest Group, Darmstadt, Sept 2013
- Int'l Conf. on Biometrics, Madrid, June 4-8, 2013
- 10th Biometric Summer School, Alghero, June 11-15, 2013
- Int'l Workshop on Biometrics and Forensics, Lisbon, Apr 4-5, 2013
- Asia Pacific Signal and Information Processing Association Conf., Hollywood, CA, Dec 2012
- IEEE Int'l Conf. on Systems, Man, and Cybernetics, Seoul, Oct, 2012
- Asian Conf. on Biometrics, Beijing, Dec 2011
- IEEE Conf. on Industrial Electronics & Applications, Beijing, June 2011

- EU TURBINE Workshop, Brussels, Jan 2011
- SIAM SDM Workshop, Columbus, Ohio, May 2010
- Biometric ID Management and Multimodal Communication, Madrid, Sept 2009
- European Conf. Machine Learning, Antwerp, Sept 2008
- Int'l Symposium on Data, Information & Knowledge Spectrum, Amritapuri, India, Dec 2007
- 12th Ibero-American Congress on Pattern Recognition, Valparaiso, Chile, Nov 2007
- 4th Int'l Conf. on Image and Graphics, Chengdu, China, Aug. 2007
- 5th Int'l Conf. on Machine Learning and Data Mining, Leipzig, July 2007
- 2nd Workshop on Computer Vision, Sao Carlos, Brazil, Oct 2006
- 19th Brazilian Sym. on Comp. Graphics, Image Proc. and Comp. Vis., Manaus, Oct 2006
- 18th Int'l Conf. Pattern Recognition, Hong Kong, Aug 2006
- Int'l Conf. on Enterprise Information Systems, Paphos, Cyprus, May 2006
- Symposium on Cryptography and Information Security, Hiroshima, Japan, Jan 2006
- 1st Int'l Conf. Pattern Recognition & Machine Intelligence, Kolkata, India, Dec 2005
- 13th Int'l Conf. Image Analysis and Processing, Cagliari, Italy, Sept 2005
- 14th Scandinavian Conf. Image Analysis, Joensuu, Finland, June 2005
- Korea Computer Vision and Pattern Recognition Society Meeting, Seoul, Dec 2004
- NATO Workshop on Information Security, Ottawa, Oct. 2004
- MIT Technology Review, Emerging Technology Conf., Sept. 2004
- 17th Int'l Conf. Pattern Recognition, Cambridge, England, Aug. 2004
- IEEE Signal Processing and Applications Conf., Kusadasi, Turkey, Apr 2004
- European Union COTS Workshop on Biometrics, Vigo, Spain, Mar 2004
- Sino Biometrics Conf., Beijing, Dec. 2003; Xian, Aug. 2002
- Fifth Int'l Conf. On Advances in Pattern Recognition, Calcutta, Dec. 2003
- Fifth Int'l Conf. On Multimodal Interfaces, Vancouver, Nov. 2003
- German Pattern Recognition Society Conf., Magdeburg, Germany, Sept. 2003
- Austrian Pattern Recognition Society Conf., Vienna, June 2003
- 1st Int'l Conf. on Diagnostic Imaging and Analysis, Shanghai, Aug. 2002
- IAPR Workshop on Statistical & Structural Pattern Recognition, Windsor, Aug. 2002
- MITAC Annual Meeting, Vancouver, May 2002
- Dow Lecture, Saginaw Valley State University, Saginaw, Feb. 2002
- 3rd Audio- Video-Based Person Authentication Conf., Halmstad, Sweden, June 2001
- Workshop on Texture, Oulu, Finland, June 1999
- Int'l Symposium on Multispectral Image Analysis, Wuhan, Oct. 1998
- Computer Vision Graphics and Image Proc. Conf., Taipei, Aug. 1998
- Irish Machine Vision and AI Conf., Derry, N. Ireland, Sept. 1997
- Energy Minimization Methods in Computer Vision & Pattern Recog., Venice, May 1997
- 2nd Asian Conf. on Computer Vision, Singapore, Dec. 1995
- 8th Int'l Conf. Image Analysis and Processing, San Remo, Sept. 1995
- IEEE World Congress on Computational Intelligence, Orlando, July 1994
- 8th Scandinavian Conf. on Image Analysis, Tromso, May 1993

- Digital Image Computing Techniques & Applications, Melbourne, Dec. 1991
- American Association of Physicists in Medicine, San Francisco, July 1991

INVITED TALKS

Mohamed bin Zayed University of Artificial Intelligence, UAE, Sep 2020; University of Cagliari, Italy, July 2020; Privacy and Technology Colloquium, Jun 2020; Beijing Academy of AI (BAAI), China, Jun 2020; University of Haifa, Feb 2020; University of Miami, Nov 2019; IIAI, Abu Dhabi, Oct 2019; KDD Panel on Why, What & How we Democratize Data Science, Anchorage, Aug 2019; ID4Africa Panel on Infant Biometrics, Johannesburg, Jun 2019; Beihang University, Mar 2019; IIIT-Hyderabad, Hyderabad, Oct 2018; Hong Kong Baptist University, Hong Kong, Oct 2018; Universidad Autonoma de Madrid, Madrid, Sept 2018; Sichuan University, Chengdu, Aug 2018; Xidian University, Xi'an, Aug 2018; Bill & Melinda Gates Foundation, Seattle, Mar 2018; World Food Program, Nairobi, Jan 2018; University of the West Indies, Port of Spain, Jan 2018; Norwegian University of Science and Technology, Gjøvik, Jan 2018; Sandia National Lab, Nov 2017; Yonsei University, Seoul, Korea, June 2017; MNIT, Jaipur, Jan 2016; Hong Kong Baptist University, Dec 2015; Sichuan University, Chengdu, Dec 2015; University of North Texas, Denton, Oct 2015; MIT Workshop on "A Turing++ Question: Who is there?", Sept, 2015; SAMSI Program on Forensics, Research Triangle Park, Aug 2015; Rowan University, July 2015; Hong Kong Baptist University, Apr 2015; Dayalbagh University, Agra, Mar 2015; Noblis, Falls Church, VA, Nov 2014; University of Zagreb, May 2014; Wayne State University, Apr 2014; Dept. of Math, Michigan State University, Apr 2014; University of South Florida, Feb 2014; Boston University, Jan 2014; NSF/DARPA/FBI Workshop on Frontiers of Image Analysis, Jan 2014; Indian Institute of Technology, Bombay, Dec 2013; Sogang University, Nov 2013; Yonsei University, Oct 2013; Institute of Information Science, Academia Sinica, Taipei, Oct 2013; University of Indonesia, Jakarta, Sept 2013; IDIAP, Martigny, Sept 2013; Qualcomm, San Diego, May 2013; University Autonoma, Madrid, June 2013; Yonsei University, Seoul, June 2013; MorphoTrust, Boston, Mar 2013; IIIT, New Delhi, Feb 2013; Dayalbagh University, Agra, Feb 2013; 3M Cogent systems, Dec 2012; University of Texas, Austin, Dec 2012; University of Notre Dame, Nov 2012; 2012 Michigan Biometrics Conf., Grand Rapids, Oct 2012; Postech, Pohang, Oct 2012; Sogang University, Seoul, Sept 2012; Korea University, Seoul, Sept 2012; Life Technologies, Foster City, July 2012; City University of Hong Kong, June 2012; National Laboratory for Pattern Recognition, Beijing, June 2012; King Mankut University of Technology, Bangkok, Mar 2012; Sichuan University, Chengdu, June 2011; University of Miami, Apr 2011; Fujitsu Labs, Tokyo, Dec 2010; Suprema, Seoul, Dec 2010; Hong Kong University Science & Technology, Dec 2010; Korea University, Sept 2010; Beijing Behang University, June 2010; Institute for Infocomm Research, Singapore, June 2010; Universiti Sains Malaysia, Penang, June 2010; Multimedia University, Mallaca, June 2010; University of Louisville, Apr 2010; Samsung R&D, Dallas, Apr 2010; University of Florida, Feb 2010; Chosun University, Dec 2009; Yonsei University, Nov 2009; University of Maryland, Oct 2009; Korea University, Oct 2009; Pusan National University, Oct 2009; Tsinghua University, June 2009; Inter American Development Bank, May 2009; University of North Texas, Apr 2009; University of Florida, Oct 2008; Chulalongkorn University, Nov 2008; TCS, Nov 2008; Istanbul Technical University, Sept. 2008; Cogent, Aug. 2008; KMUT, Bangkok, May 2008; Chiang Mai University, Chiang Mai, May 2008; Kentucky Science and Technology Foundation, Apr 2008; University of Minnesota, Apr 2008; University of Virginia, Mar 2008; University of Missouri, Columbia, Jan 2008; CMC Ltd., Hyderabad, Dec 2007; Ford Motor Company, Dearborn, Nov 2007; Information Trust Institute, University of Illinois, Urbana-Champaign, Oct. 2007; Istanbul Technical University, Sept. 2007; Tsinghua University, Beijing, Aug. 2007; Nanyang Technological University, Singapore, Mar 2007; Institute of Infocomm Research, Singapore, Mar 2007; Wayne State University, Detroit, Mar 2007; General Motors Technical Center, Feb. 2007; Yonsei University, Seoul, Jan. 2007; Hong Kong Baptist University, Jan. 2007; Department of Electrical & Computer Engineering, Ohio State University, Nov. 2006; School of Computer Science, University of Central Florida, Nov. 2006; UN-ESP, Baurau, Brazil, Oct 2006; Federal University of Parana, Curitiba, Brazil, Oct 2006; Sichuan University, Chengdu, China, Aug 2006; Institute of Automation, Beijing, Aug 2006; Lumidigm, Albuquerque, July 2006; SAGEM, Paris, June 2006; Department of Informatics, ETH, Zurich,

May 2006; University of Athens, May 2006; Aristotle University of Thessaloniki, May 2006; Kyoto University, Jan 2006; Indian Institute of Technology, Kanpur, Dec 2005; Indian Institute of Science, Bangalore, Dec 2005; Institut National Telecommunications (INT-Evry), Nov 2005; National Academy of Science Sackler Forensic Science Colloquium, Nov 2005; Dept. of Computer Science, SUNY, Buffalo, Oct 2005; Department of Electrical Engineering, Istanbul Technical University, Sept., 2005; NEC Research Labs, Princeton, July 2005; Institute of Automation, Chinese Academy of Sciences, Beijing, June 2005; Siemens Corporate Research, Princeton, Feb 2005; Symbol Technologies, Long Island, Feb 2005; Biometric Research Center, Yonsei University, Seoul, Dec 2004; Indian Institute of Technology, Mumbai, Dec 2004; CMC Research and Development Center, Hyderabad, Dec 2004; ATR Int'l, Kyoto, Nov 2004; Department of Electrical & Computer Engineering, Carnegie Mellon University, Nov. 2004; Department of Statistics, University of Goettingen, Germany, June 2004; Department of Informatics, University of Freiburg, Germany, June 2004; Department of Computer Science, ETH, June 2004; Beckman Institute, University of Illinois, Urbana, Mar 2004; Department of Computer Science, Indian Institute of Technology, Kanpur, Dec. 2003; Department of Computer Science, Hong Kong Polytechnic University, Dec. 2003; Department of Computer Science, Hong Kong University of Science & Technology, Dec. 2003; ECE Dept. Tulane University, New Orleans, Oct. 2003; CSEE Department, West Virginia University, Morgantown, Oct. 2003; "Science at the Edge" Seminar Series, Michigan State University, Sept. 2003; Philips Research Lab, Eindhoven, Sept. 2003; Department of Informatics III, University of Bonn, July 2003; Department of Computer Science, Technical University of Vienna, June 2003; Biometrics Summer School, Sardinia, June 2003; ECE Department, North Carolina State University, Mar 2003; Statistics Department, Florida State University, Feb. 2003; Computer Science Department, University Notre Dame, Jan. 2003; Dept. of Computer Science, Hong Kong Polytechnic University, Hong Kong Dec. 2002; Computer Science Dept., IUPUI, Indianapolis, Nov. 2002; Financial Sector Technical Committee (NIST), Alexandria, VA, Oct. 2002; Biometric Consortium (BC 2002), Crystal City, VA, Sept. 2002; Department of Computer Science, Sichuan University, Chengdu, Aug. 2002; Pierre Devijver Lecturer, Workshop on Structural & Statistical Patter Recognition, Windsor, Aug. 2002; National Institute of Standards & Technology (NIST), June 2002; CITER, West Virginia University, Apr 2002; GAO Panel on Biometrics, Washington D.C., Apr 2002; Department of Computing, University of Alberta, Mar 2002; NSF Workshop on Pattern Recognition, Ann Arbor, Mar 2002; Department of Electrical Engineering, University of Texas, Austin, Feb. 2002; Department of Computer Science, University of Bonn, Germany, Jan. 2002; Department of Computer Science, Western Michigan University, Nov. 2001; Department of Computer Science, Oakland University, Nov. 2001; Department of Electrical & Computer Engineering, MSU Sept. 2001; Department of Statistics, University of Michigan, Sept. 2001; Department of Computer Science, Hong Kong University Science & Technology, Aug. 2001; Department of Computer Science, Chulankongkorn University, Bangkok, Aug. 2001; Software Park, Bangkok, Aug. 2001; Department of Computer Science, King Mangkot University, Aug. 2001; Department of Statistics, Ohio State University, May 2001; Department of Electrical & Computer Engineering, University of Miami, Coral Gables, Mar 2001; National Center for Software Technology, Bombay, Dec. 4, 2000; Department of Computer Science, Indian Institute of Technology, Delhi, Dec. 1, 2000; Department of Electronic Engineering, Nanyang Technical University, Singapore, Nov. 25, 2000; National Laboratory of Pattern Recognition, Beijing, Nov. 23, 2000; Microsoft Research Laboratory, Beijing, Nov. 20-22, 2000; Eaton Corporation, Rochester Hills, Nov. 15, 2000; Department of Electrical Engineering, Istanbul Technical University, Oct. 24, 2000; Marmara Research Center, Istanbul, Oct. 23, 2000; Siemens PSE Division, Graz, Oct. 19, 2000; Siemens ICM Division, Munich, Oct. 18, 2000; Campus Interdisciplinary Seminar, MSU, Oct. 4, 2000; Lawrence Technological University, Southfield, Sept. 27, 2000; Eaton Corporation, Milwaukee, Aug. 28, 2000; West Virginia EPSCOR Workshop, Charleston, WV, Feb. 1999; University of Surrey, Guildford, England, Jan. 1999; Instituto Superior Tecnico, Lisbon, Portugal, Nov. 1998; West Virginia Science & Technology Council, Morgantown, Nov. 1998; National Laboratory for Pattern Recognition, Beijing, Oct. 1998; Academia Sinica, Taipei, Aug. 1998; National Taiwan University, Taipei, Aug. 1998; Department of Computer Science, University of Auckland, New Zealand, Aug. 1998; Department of Computer Science, New York University, Mar 1998;

University of West Virginia, Morgantown, Jan. 1998; Department of Systems Design, University of Waterloo, Sept. 1997; LG Electronic Research Center, Princeton, Aug. 1997; School of Automation, Indian Institute of Science, Bangalore, July 1997; Bell Labs, Lucent Technologies, Naperville, July 1997; National Centre for Software Technology, Bombay, July 1997; Department of Computer Science, Sichuan Union University, Chengdu, June 1997; Department of Computer Science, Hong Kong University Science & Technology, June 1997; University of Cagliari, Italy, May 1997; Department of Computer Science, Ohio State University, May 1997; University of Indonesia, Jakarta, May 1997; NEC Research Laboratory, Princeton, Feb. 1997

PATENTS

1. A. K. Jain, U. Park and H. C. Choi, "Apparatus and method for monitoring", Korean Patent No. 10-1170269, July 25, 2012.
2. A. K. Jain, U. Park and H. C. Choi, "Apparatus and method for monitoring using beam splitter", Korean Patent No. 10-1150563, May 21, 2012.
3. A. K. Jain, L. Hong, R. Bolle and S. Pankanti, "System and Method for Deriving a string-based representation of a fingerprint image", U.S. Patent No. 6,487,306, Nov. 26, 2002.
4. A. K. Jain, L. Hong, R. Bolle and S. Pankanti, "System and Method for Matching (Fingerprint) Images Using an Aligned String-Based Representation", U.S. Patent No. 6,185,318, Feb. 6, 2001.
5. A. K. Jain, L. Hong, R. Bolle and S. Pankanti, "System and Method For Identifying Foreground And Background Portions Of Digitized Images", U.S. Patent No. 6,263,091, July 17, 2001.
6. A. K. Jain, L. Hong, R. Bolle and S. Pankanti, "System and Method for Determining Block Direction in Fingerprint Images", U.S. Patent No. 6,289,112 Sept. 11, 2001.
7. A. K. Jain, L. Hong, R. Bolle and S. Pankanti, "Determining An Alignment Estimation Between Two (Fingerprint) Images", U.S. Patent No. 6,314,197, Nov. 6, 2001.
8. A. K. Jain, L. Hong, R. Bolle and S. Pankanti, "Determining A Point Correspondence Between Two Points in Two Respective (Fingerprint) Images", U.S. Patent No. 6,049,621, Apr 11, 2000.

PUBLICATIONS

BOOKS

1. S. Z. Li and A. K. Jain (eds.), *Encyclopedia of Biometrics*, 1st Edition, Springer 2009; 2nd Edition, Springer, 2015.
2. S. Z. Li and A. K. Jain (eds.), *Handbook of Face Recognition*, 1st Edition, Springer 2005; 2nd Edition, Springer, 2011.
3. A. K. Jain, A. Ross and K. Nandakumar, *Introduction to Biometrics*, Springer, 2011.
4. A. K. Jain, A. Ross and P. J. Flynn (eds.), *Handbook of Biometrics*, Springer, 2007.
5. A. Ross, K. Nandakumar and A. K. Jain, *Handbook of Multibiometrics*, Springer, 2006.
6. J. L. Wayman, A. K. Jain, D. Maltoni and D. Maio (eds.), *Biometric Systems: Technology, Design and Performance Evaluation*, Springer, 2005.
7. D. Maltoni, D. Maio, A. K. Jain and S. Prabhakar, *Handbook of Fingerprint Recognition*, 1st Edition, Springer-Verlag, 2003; 2nd Edition, 2009.
8. A. K. Jain, S. Pankanti and R. Bolle (eds.), *BIOMETRICS: Personal Identification in Networked Society*, Kluwer, 1999.
9. A. K. Jain and P. J. Flynn (eds.), *3D Object Recognition Systems*, Elsevier, 1993.
10. R. Chellappa and A. K. Jain (eds.), *Markov Random Fields: Theory and Applications*, Academic Press, 1993.

11. I. Sethi and A. K. Jain (eds.), *Neural Networks and Statistical Pattern Recognition*, North Holland, 1991.
12. R. Jain and A. K. Jain (eds.), *Analysis and Interpretation of Range Images*, Springer Verlag, 1990.
13. A. K. Jain and R. C. Dubes, *Algorithms for Clustering Data*, Prentice Hall, 1988.

JOURNAL ARTICLES

1. J. J. Engelsma, D. Deb, K. Cao, A. Bhatnagar, P. S. Sudhish and A. K. Jain, "Infant-ID: Fingerprints for Global Good", to appear in the *IEEE Trans. on Pattern Analysis and Machine Intelligence*, DOI 10.1109/TPAMI.2021.3057634, 2021
2. D. Deb and A. K. Jain, "Look Locally Infer Globally: A Generalizable Face Anti-Spoofing Approach", in *IEEE Trans. Information Forensics and Security*, DOI 10.1109/TIFS.2020.3029879, 2020.
3. J. Liang, H. Tu, F. Liu, Q. Zhao and A. K. Jain, "3D face reconstruction from mugshots: Application to arbitrary view face recognition", in *Neurocomputing*, DOI 10.1016/j.neucom.2020.05.076, 2020.
4. T. Chugh and A. K. Jain, "Fingerprint Spoof Detector Generalization", in *IEEE Transaction on Information Forensics and Security*, DOI 10.1109/TIFS.2020.2990789, 2020.
5. H. Xu, Y. Ma, Hao-C. Liu, D. Deb, H. Liu, Ji-L. Tang, A. K. Jain, "Adversarial Attacks and Defenses in Images, Graphs and Text: A Review", in *International Journal of Automation and Computing*, DOI 10.1007/s11633-019-1211-x, 2020.
6. J. J. Engelsma, K. Cao and A. K. Jain, "Learning a Fixed-Length Fingerprint Representation", in *IEEE Trans. on Pattern Analysis and Machine Intelligence*, DOI 10.1109/TPAMI.2019.2961349, 2019.
7. H. Yang, D. Huang, Y. Wang, A. K. Jain, "Learning Continuous Face Age Progression: A Pyramid of GANs", in *IEEE Trans. on Pattern Analysis and Machine Intelligence*, DOI 10.1109/TPAMI.2019.2930985, Jul 2019.
8. K. Cao, D. Nguyen, C. Tymoszek and A. K. Jain, "End-to-End Latent Fingerprint Search", in *IEEE Trans. on Information Forensics and Security*, DOI 10.1109/TIFS.2019.2930487, Jul 2019.
9. G. Mai, K. Cao, Pong C. Yuen and A. K. Jain, "On The Reconstruction Of Face Images From Deep Face Templates", *IEEE Transactions on Pattern Analysis and Machine Intelligence*, Vol. 41, No. 5, pp. 1188-1202, May 2019.
10. K. Cao and A. K. Jain, "Automated Latent Fingerprint Recognition", *IEEE Transactions on Pattern Analysis and Machine Intelligence*, Vol. 41, No. 4, pp. 788-800, Apr 2019.
11. Y. Shi and A. K. Jain, "DocFace+: ID Document to Selfie Matching", *IEEE Transactions on Biometrics, Behavior and Identity Science*, Vol. 1, No. 1, pp. 56-67, Jan 2019.
12. H. Han, J. Li, A. K. Jain, S. Shan and X. Chen, "Tattoo Image Search at Scale: Joint Detection and Compact Representation Learning", to appear in *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 2019.
13. J. Engelsma, K. Cao and A. K. Jain, "RaspiReader: An Open Source Fingerprint Reader", to appear in *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 2018.
14. L. Best-Rowden and A. K. Jain, "Learning Face Image Quality From Human Assessments", *IEEE Transactions on Information Forensics and Security*, Vol. 13, No. 12, pp. 3064-3077, Dec 2018.

15. H. Han, A. K. Jain, F. Wang, S. Shan, and X. Chen, "Heterogeneous Face Attribute Estimation: A Deep Multi-Task Learning Approach", *IEEE Trans. Pattern Analysis & Machine Intelligence*, Vol. 40, No. 11, Nov 2018.
16. T. Chugh, K. Cao, and Anil K. Jain, "Fingerprint Spoof Buster: Use of Minutiae-centered Patches", *IEEE Transactions on Information Forensics and Security*, Vol. 13, No. 9, pp. 2190-2202, Sep 2018.
17. Y. Shi, C. Otto and A. K. Jain, "Face Clustering: Representation and Pairwise Constraints", *IEEE Transactions on Information Forensics and Security*, Vol. 13, No. 7, pp. 1626-1640, Jul 2018.
18. J. Engelsma, S. S. Arora, A. K. Jain and N. Paulter, "Universal 3D Wearable Fingerprint Targets: Advancing Fingerprint Reader Evaluations", *IEEE Transactions on Information Forensics and Security*, Vol. 13, No. 6, pp.1564-1578, Jun 2018.
19. C. Otto, D. Wang and A. K. Jain, "Clustering Millions of Faces by Identity", *IEEE Transactions Pattern Analysis & Machine Intelligence*, Vol. 40, No. 2, pp. 289-303, Feb. 2018.
20. T. Chugh, K. Cao, J. Zhou, E. Tabassi and A. K. Jain, "Latent Fingerprint Value Prediction: Crowd-based Learning", *IEEE Transactions on Information Forensics and Security*, Vol. 13, No. 1, pp. 20-34, Jan 2018.
21. S. S. Arora, A. K. Jain and N. G. Paulter, "Gold Fingers: 3D Targets for Evaluating Capacitive Readers", *IEEE Transactions on Information Forensics and Security*, Vol. 12, No. 9, pp. 2067-2077, Sep 2017.
22. A. K. Jain, S. S. Arora, K. Cao, L. Best-Rowden and A. Bhatnagar, "Fingerprint Recognition of Young Children", *IEEE Transactions on Information Forensics and Security*, Vol. 12, No. 7, pp. 1501-1514, July 2017.
23. D. Crouse, R. Jacobs, S. Klum, Z. Richardson, A. K. Jain, A. Baden and S. Tecot, "LemurFaceID: A Face Recognition System to facilitate Individual Identification of Lemurs", *BMC Zoology*, Feb. 2017.
24. L. Best-Rowden and A. K. Jain, "Longitudinal Study of Automatic Face Recognition", *IEEE Trans. Pattern Analysis & Machine Intelligence*, Vol. 40, No. 1, pp. 148-162, Jan 2017.
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PH.D. STUDENTS
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2. Yichun Shi, "Towards a Robust Unconstrained Face Recognition Pipeline with Deep Neural Networks", 2021 (ByteDance)
3. Joshua Engelsma, "Contributions to Fingerprint Recognition", 2021 (Amazon)
4. Sixue Gong, "Face Recognition: Representation, Intrinsic Dimensionality, Capacity, and Demographic Bias", 2021 (Microsoft)
5. Tarang Chugh, "An Accurate, Efficient, and Robust Fingerprint Presentation Attack Detector", 2020 (Amazon)
6. Inci M. Baytas, "Contributions to Machine Learning in Biomedical Informatics", 2019 (Bogazici University, Istanbul)
7. Lacey Best-Rowden, "Face Recognition: Role of Aging and Quality Covariates", 2017 (Visa Innovations)
8. Sunpreet S. Arora, "Fingerprint Recognition: Contributions to Latent Matching and 3D Fingerprint Target Generation", 2016 (Visa Research)
9. Charles Otto, "Face Search and Clustering at Scale", 2016 (Nobilis)
10. Radha Chitta, "Kernel-Based Clustering of Big Data", 2015 (Kira Systems)
11. Serhat S. Bucak, "Multiple Kernel and Multi-label Learning for Image Categorization", 2014 (Google)
12. Soweon Yoon, "Fingerprint Recognition: Models and Applications", 2014 (NIST)
13. Alessandra A. Paulino, "Contributions to Biometric Recognition: Matching Identical Twins and Latent Fingerprints", 2013 (Federal University of Uberlandia, Brazil)
14. Kien Nguyen, "Contributions to Computer-aided Diagnosis of Prostate Cancer in Histopathology", 2013 (Genentech)
15. Brendan Klare, "Heterogeneous Face Recognition", 2012 (Rank One Computing)
16. Abhishek Nagar, "Biometric Template Security", 2012 (Samsung)
17. Pavan Kumar Mallapragada, "Some Contributions to Semi-supervised Learning", 2010 (Microsoft)
18. Unsang Park, "Face Recognition: Face in Video, Age Invariance, and Facial Marks", 2009 (Sogang University)
19. Yi Chen, "Extended Feature set and Touchless Imaging for Fingerprint Matching", 2009 (Fingerprint Cards)

20. Karthik Nandakumar, "Multibiometric Systems: Fusion Strategies and Template Security", 2008 (Mohamed bin Zayed University of Artificial Intelligence)
21. Hong Chen, "Dental Biometrics", 2007 (Wish)
22. Xiaoguang Lu, "3D Face Recognition", 2006 (Siemens Research)
23. Martin Law, "Clustering and Dimensionality Reduction", 2006 (Google)
24. Umut Uludag, "Secure Biometric Systems", 2006 (NRIEC, Istanbul)
25. Anoop Namboodiri, "On-line Handwritten Document Understanding", 2004 (IIIT, Hyderabad)
26. Michael Farmer, "Segmentation, Classification, and Tracking of Humans for Smart Airbag Applications", 2004 (University of Michigan, Flint)
27. Arun Ross, "Information Fusion in Fingerprint Authentication", 2003 (Michigan State University)
28. Rein-Lien Hsu, "Face Detection, Recognition and Tracking", 2002 (IDEMIA)
29. Salil Prabhakar, "Fingerprint Matching and Classification Using a Filterbank", 2001 (DeltaID)
30. Aditya Vailaya, "Semantic Classification of Images", 2000 (MuleSoft)
31. Scott Connell, "On-line Cursive Handwriting Recognition", 2000 (Centauri)
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35. Nalini Ratha, "Computer Vision Algorithms on Reconfigurable Logic Arrays", 1996 (University at Buffalo)
36. Chitra Dorai, "Representation and Recognition of 3-D Objects with Free-Form Surfaces", 1996 (Amicus)
37. Sharathchandra Pankanti, "Integration of Vision Modules", 1995 (Microsoft)
38. Marie-Pierre Dubuisson, "Segmentation and Matching of Vehicles from Complex Color Outdoor Scenes", 1995 (retired from Siemens)
39. Jianchang Mao, "Design and Analysis of Neural Networks for Pattern Recognition", 1994 (Google)
40. Hans Dulimarta, "Client Server Control Architecture for Robot Navigation", 1994 (Grand Valley State University)
41. Timothy S. Newman, "Experiments in CAD-Based Inspection", 1993 (University of Alabama, Huntsville)
42. Sateesha G. Nadabar, "Markov Random Field Models in Computer Vision", 1992 (SharpSight LLC)
43. Narayan S. Raja, "Parts Based 3D Object Recognition", 1992 (University of Hawaii)
44. Farshid Farrokhnia, "Multi Channel Filtering Techniques for Texture Segmentation and Surface Quality Inspection", 1990 (GE Medical Systems)
45. Patrick Flynn, "CAD Based Computer Vision: Modeling and Recognition Strategies", 1990 (University of Notre Dame)
46. Jezching Ton, "A Knowledge Based Approach to Landsat Image Interpretation", 1989 (deceased)
47. Richard Hoffman, "Object Recognition From Range Images", 1986 (Northrop Grumman)
48. James Coggins, "A Framework for Texture Analysis Based on Spatial Filtering", 1982 (retired from ViaSat)

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